CLAIMS

What Is Claimed Is:

1. An electromagnetic pulse generator comprising:

a control unit;

a first input stage having a data input terminal; and

a plurality of switching elements coupled to the input stage, the switching elements responsive to a first voltage level and a second voltage level;

wherein the control unit provides a transition signal from the first voltage level to the second voltage level.

2. The electromagnetic pulse generator of claim 1, wherein the control unit is selected from a group consisting of: a digital computer, and a digital to analog converter including computer logic for controlling the digital to analog converter.

3. The electromagnetic pulse generator of claim 1, wherein the first input stage comprises a differential pair.

4. The electromagnetic pulse generator of claim 1, wherein the first voltage level is greater than the second voltage level.

5. The electromagnetic pulse generator of claim 1, wherein the transition signal from the first voltage level to the second voltage level is provided by the control unit.

6. The electromagnetic pulse generator of claim 1, wherein the switching elements are selected from a group consisting of: differentially paired transistors and differentially paired diodes.

7. The electromagnetic pulse generator of claim 1, wherein the electromagnetic pulses may vary in amplitude from about –5 volts to about 5 volts.

8. The electromagnetic pulse generator of claim 1, wherein the electromagnetic pulses may have a duration from about 1 pico-second to about 1 milli-second.

9. The electromagnetic pulse generator of claim 1, wherein the plurality of electromagnetic pulses represent data.

10. The electromagnetic pulse generator of claim 1, wherein the plurality of electromagnetic pulses are employed in an ultra-wideband communication system.

11. The electromagnetic pulse generator of claim 1, wherein a plurality of electromagnetic pulses produced by the electromagnetic pulse generator are aggregated to form a sinusoidal waveform.

12. The electromagnetic pulse generator of claim 11, wherein the sinusoidal waveform is employed to transmit data.

13. An electromagnetic pulse generating circuit comprising:

a differential pair having at least two gate terminals coupled to at least two input terminals;

at least two switching elements coupled to the differential pair, the switching elements responsive to a first voltage level and a second voltage level;

at least two digital to analog converters configured to selectively provide a positive and a negative activation signal to the switching elements; and

a digital computer communicating with the digital to analog converters to control the positive and negative activation signals.

14. The electromagnetic pulse generating circuit of claim 13, wherein a transition of the positive activation signal from a first voltage level to a second voltage level generates an electromagnetic pulse when the positive activation signal is between a first switching point and a second switching point.

15. The electromagnetic pulse generating circuit of claim 14, wherein the first voltage level is greater than the second voltage level.

16. The electromagnetic pulse generating circuit of claim 13, wherein a transition of the negative activation signal from a first voltage level to a second voltage level generates an electromagnetic pulse when the negative activation signal is between a first switching point and a second switching point.

17. The electromagnetic pulse generating circuit of claim 16, wherein the first voltage level is greater than the second voltage level.

18. The electromagnetic pulse generating circuit of claim 13, wherein the switching elements comprise at least two transistors.

19. The electromagnetic pulse generating circuit of claim 13, wherein the switching elements comprise at least two diodes.

20. An electromagnetic pulse generating circuit comprising:

a first pair of differentially paired transistors having at least two gate terminals connected to at least two input terminals, at least two drain terminals, and at least two source terminals connected to a current source;

a second pair of differentially paired transistors having at least two gate terminals coupled to a first voltage level, with at least two source terminals coupled to the drain terminals of the first pair of transistors;

a third pair of differentially paired transistors having at least two gate terminals connected to a digital to analog converter, with at least two source terminals coupled to the drain terminals of the second pair of transistors;

a digital computer connected to the digital to analog converter;

a fourth pair of differentially paired transistors having gate terminals connected to a third voltage level, with at least two source terminals coupled to the drain terminals of

the third pair of transistors, and at least two drain terminals connected to a differential output; and

a first resistive element and a second resistive element each having a first terminal connected to a power supply and a second terminal connected to the drain terminals of the fourth pair of differentially connected transistors.

21. The electromagnetic pulse generating circuit of claim 20, wherein the second, third, and fourth pairs of differentially paired transistors comprise switching elements responsive to the first voltage level, the third voltage level and the output of the digital to analog converter.

22. The electromagnetic pulse generating circuit of claim 20, wherein the digital to analog converter is controlled by computer logic stored in the digital computer.

23. The electromagnetic pulse generating circuit of claim 20, wherein the first, second, third and fourth differentially paired transistors are activated by the digital to analog converter to generate an electromagnetic pulse when the output of the digital to analog converter is greater than the first voltage but less than the third voltage.

24. The electromagnetic pulse generating circuit of claim 20, further comprising:

a capacitor connected to the differential output.

25. The electromagnetic pulse generating circuit of claim 20, further comprising:

a fifth pair of differentially paired transistors having at least two gate terminals connected to the digital to analog converter, and a source terminal connected to at least two drain terminals of the third pair of differentially connected transistors and to the source terminals of the fourth pair of differentially paired transistors.

26. The electromagnetic pulse generating circuit of claim 20, further comprising:

a sixth pair of differentially paired transistors having at least two gate terminals connected to a second voltage level, and at least two source terminals connected to the drain terminals of the second pair of differentially connected transistors, and a drain terminal connected to the power supply.

27. The electromagnetic pulse generating circuit of claim 20, further comprising:

a demultiplexer connected to each of the differentially paired transistors without a digital to analog converter, and to the digital computer.

28. The electromagnetic pulse generating circuit of claim 20, wherein the differentially paired transistors are selected from a group consisting of: a gallium arsenide (GaAs) transistor, a MESFET transistor, a GaAs hetrojunction bipolar transistor (HBT), a GaAs high electron mobility transistor (HEMT), an indium phosphate transistor, a silicon germanium transistor, a silicon bipolar transistor, and a MOS transistor.

29. An electromagnetic pulse generating system comprising:

control means for generating a plurality of digital signals;

demultiplexing means for demultiplexing the plurality of digital signals;

electromagnetic pulse generating means for generating a plurality of electromagnetic pulses in response to the plurality of digital signals; and

aggregating means for combining the plurality of electromagnetic pulses.

30. The electromagnetic pulse generating system of claim 29, wherein the aggregating means combines the plurality of electromagnetic pulses into a desired sinusoidal waveform or into a group of electromagnetic pulses.

31. The electromagnetic pulse generating system of claim 29, wherein the plurality of electromagnetic pulses are generated in response to a voltage transition in a one the plurality of digital signals.

32. The electromagnetic pulse generating system of claim 29, wherein the control means comprises a digital computer microprocessor controlled by computer logic.

33. The electromagnetic pulse generating system of claim 29, wherein the control means comprises a finite state machine.

34. The electromagnetic pulse generating system of claim 29, wherein the electromagnetic pulse generating means comprises:

a digital to analog conversion circuit, configured to receive the digital signal from the demultiplexing means; and

a plurality of connected pulse generation circuits, wherein each pulse generation circuit is responsive to a voltage transition of an output from the digital to analog conversion circuit.

35. The electromagnetic pulse generating system of claim 29, wherein the electromagnetic pulse generating means are connected in parallel.

36. The electromagnetic pulse generating system of claim 29, wherein the electromagnetic pulse generating means are connected in series.

37. The electromagnetic pulse generating system of claim 29, wherein the aggregating means comprises a summing circuit.

38. The electromagnetic pulse generating system of claim 29, wherein the aggregating means includes a multiplier.

39. A method of generating an electromagnetic pulse, the method comprising the steps of:

providing a digital computer containing computer logic;

transitioning an output of a digital to analog conversion circuit from a first voltage level to a second voltage level;

generating a first electromagnetic pulse in response to the voltage transition; and

generating a second electromagnetic pulse in response to a second voltage transition.

40. The method of generating the electromagnetic pulse of claim 39, wherein the step of generating the second electromagnetic pulse in response to the second voltage transition comprises:

generating the second electromagnetic pulse when an output of the digital to analog conversion circuit transitions from the second voltage level to the first voltage level.

41. The method of generating the electromagnetic pulse of claim 39, further comprising the step of:

maintaining a steady state when a voltage level of the digital to analog conversion circuit is outside a voltage range of the first voltage level and the second voltage level.

42. The method of generating the electromagnetic pulse of claim 39, wherein the first electromagnetic pulse is generated when the output from the digital to analog conversion circuit reaches a first switching point and ceases when the output of the digital to analog conversion circuit reaches a second switching point, the first and second switching points occurring between the first and second voltage levels.

43. The method of generating the electromagnetic pulse of claim 39, wherein the second electromagnetic pulse is generated when the output of the digital to analog

conversion circuit reaches a second switching point and ceases when the output of the digital to analog conversion circuit reaches a first switching point, the first and second switching points occurring between the first and second voltage levels.

44. A method of generating an output signal in a computer circuit, the method comprising the steps of:

providing a digital computer;

generating the output signal having two transitions in response to a single transition of a control signal sent by the digital computer;

wherein a first transition of the two transitions is a rise of the output signal from an initial voltage to a second voltage; and

wherein a second transition of the two transitions is a fall of the output signal to the initial operating voltage.

45. The method of generating an output signal in a computer circuit of claim 44, wherein the computer circuit includes at least two differentiating circuit elements comprising capacitors.

46. The method of generating an output signal in a computer circuit of claim 44, wherein the digital computer comprises a digital to analog conversion circuit.

47. The method of generating an output signal in a computer circuit of claim 44, wherein the computer circuit includes a signal reversing element comprising a transmission line or a delay line.

48. A method of generating an output signal in a computer circuit, the method comprising the steps of:

providing a digital computer;

sending a control signal from the digital computer, the control signal including a voltage transition;

conveying to one or more computer circuit output terminals a voltage proportional to the voltage on one or more respective input terminals; and

wherein the voltage conveyed to the one or more output terminals is proportional to the voltage on the one or more input terminals during a time when the voltage transition occurs in the control signal.

49. The method of generating an output signal in a computer circuit of claim 48, wherein the computer circuit includes at least two differentiating circuit elements comprising capacitors.

50. The method of generating an output signal in a computer circuit of claim 48, wherein the digital computer comprises a digital to analog conversion circuit.

51. The method of generating an output signal in a computer circuit of claim 48, wherein the computer circuit includes a signal reversing element comprising a transmission line or a delay line.

52. The method of generating an output signal in a computer circuit of claim 48, further comprising the step of:

holding the voltage on the one or more output terminals after the transition of the control signal.

53. The method of generating an output signal in a computer circuit of claim 52, wherein, the holding is provided by an electric storage comprising a capacitor.

54. A method of transmitting data, the method comprising the steps of:

receiving data for transmission;

modulating the data;

providing an electromagnetic pulse generating circuit;

generating a plurality of electromagnetic pulses arranged to represent the modulated data; and

transmitting the plurality of electromagnetic pulses.

55. The method of transmitting data of claim 54, wherein the step of generating a plurality of electromagnetic pulses comprises means for generating a plurality of electromagnetic pulses.